

## India's Technology Intensive Exports: How far outsourcing enables it? An Analysis of India's Exports from 1990 to 2015

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**Abstract:** The pattern of India's share of high and medium technology exports in total manufactured exports doesn't get reflected in world exports of technology intensive exports. In this paper, by taking three sectors belonging to different technology-intensive categories (textiles, apparels & footwear, electronics & computer and motor vehicles), with increase in India's participation in Global Value Chain (GVC), the gross exports of these sectors have increased but the ratio of backward participation to forward participation has also increased. However, when gross exports are further divided into intermediate and final goods, the correlation of these exports with the ratio of Foreign Value Added (FVA) to Domestic Value Added (DVA) for the sectors concerned, comes out significantly negative. Thus, how much increase in domestic value addition can enable in further increase in exports and how India is able to leverage its participation in GVCs to become more efficient by maximising the income and benefits is the question which needs further analysis.

**Keywords:** Technology intensive exports, GVC, Structural-break analysis, technology

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### I. Introduction

Outsourcing of intermediate goods and business services is one of the rapidly growing segments of international trade. For quite some time, mostly developing countries have been dominating this segment. According to UNCTAD (2013), "about 60 per cent of global trade, which today amounts to more than \$20 trillion, consists of trade in intermediate goods and services that are incorporated at various stages in the production process of goods and services for final consumption." The declining communication and transport costs further allow slicing up the production of a single commodity to be spread across the most economically viable countries (Sachs, 1997) within the global network system of multinational companies (MNCs). Thus, this unbundling of the production process in the global value chain (GVC) phenomenon can be both geographical (across countries) and organizational (across firms) where each participant adds value to finally produce the end product.

Over time, resource-seeking foreign direct investment (FDI) (that is, FDI which sought to exploit lower production costs) has led to shifting the focus of global trade from trade in final consumer items (goods and services) to trade in intermediate inputs. The opportunity to generate value by acquiring knowledge and technology by learning from and interacting with other value chain actors in an integrated production process (e.g. Hausmann, 2014) has rendered the participation in GVC very important.

The unbundling of tasks and business functions relating to value chains might have opened opportunities for developing countries to engage in global markets without having to develop complete products or value chains (Stamm, 2004; Baldwin, 2012; Escaith, 2014; OECD, 2013). However, the participation in GVCs enabling increase in the trade interconnectedness, leading to overall rise in countries' economic growth, has not completely pushed India into GVCs as its participation remains lower than that of the other developing economies in Asia (Athukorala, 2011). The manufacturing sector has multiple spill overs, and with it getting more integrated into the GVC, producing specialised items of a finished product, the opportunity to create more employment and contributing to global export is high.

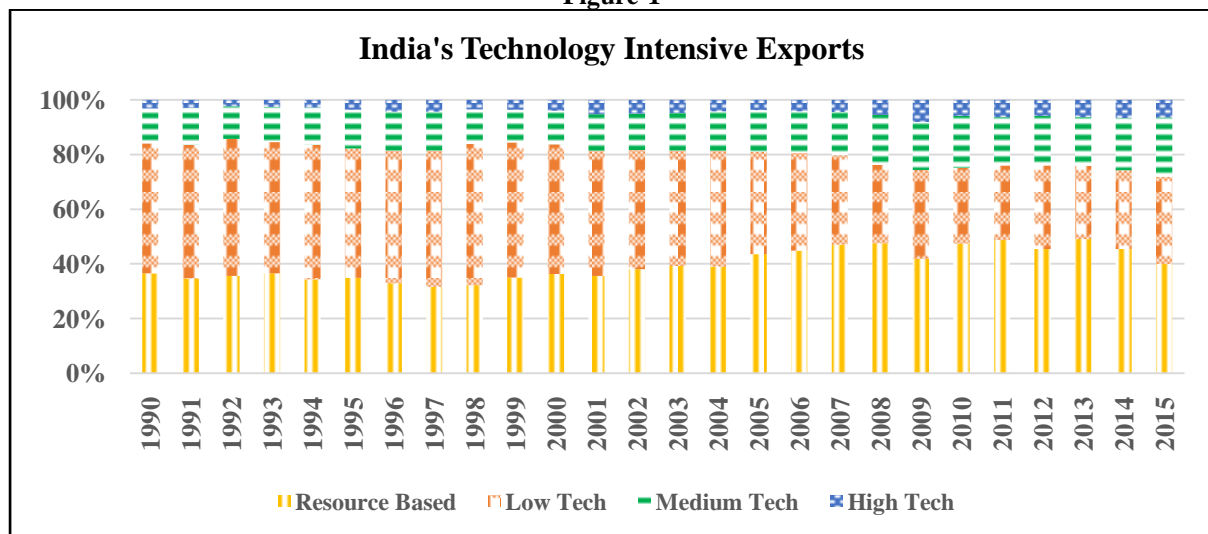
India's performance in technology intensive exports (figure-1) from 1990 onwards has concentrated more towards resource based and low-technology exports. The share of high-technology products is not significantly high in India's total manufactured export to world. The increase in "high technology" exports suggests that learning and industrial upgrading is taking place in the exporting country (Lall, 2000). And industrial upgrading is defined by Gereffi (2005) as the "the process by which economic actors – nations, firms and workers – move from low-value to relatively high-value activities in global production networks".

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However, India's exports have been dominated by products like petroleum, mineral fuels & oils, semi-precious stones and articles of apparel and clothing.

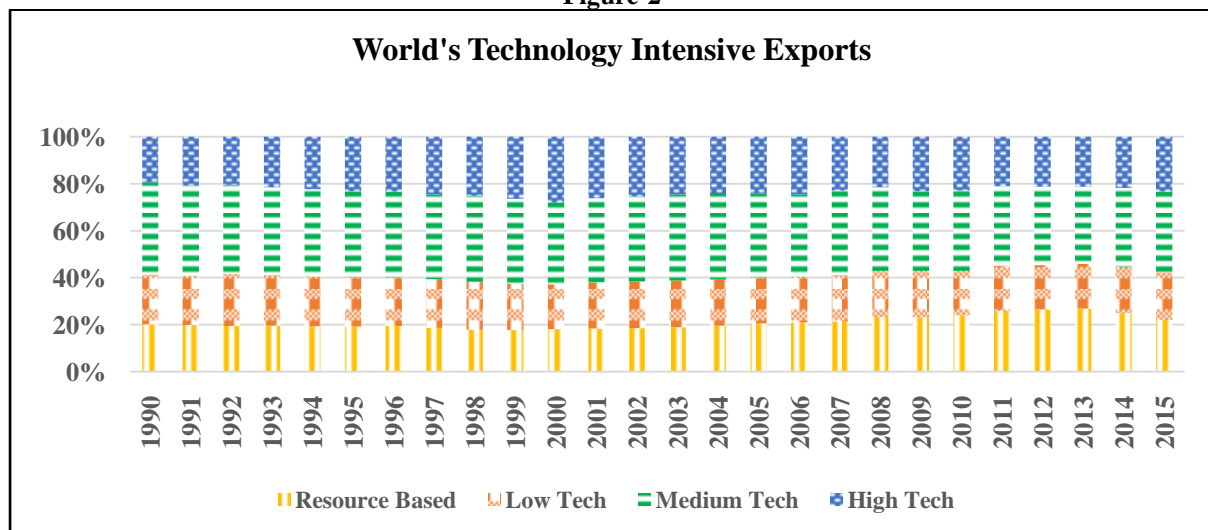
Figure-1



Source- Calculated from WITS UN-Comtrade

The trend of world exports (figure-2), shows that share of high-tech and medium high-tech products have dominated the exports. India's exports, thus, do not match world's share and trend of technology-intensive exports. We, in this paper analyse, if this mis-match in the trend of exports between India and world has been bridged by India participating in GVC by using OECD-WTO-TIVA database. As, the industrial output and trade statistics may provide a very partial and even misleading view of where value is created and captured in the global economy.

Figure-2



Source- Calculated from WITS UN-Comtrade

The analysis involves breaking down the India's export structure into intermediate and final goods for different technology intensive sectors. The three industries considered to be the most fragmented in their production process and thus, which belong at the forefront of global economic integration: 1) electronics, 2) automobiles and motorcycles, and 3) apparel and footwear are taken for sector-wise analysis. Also, the process of outsourcing brings greater value when the products being imported are neither basic raw materials, nor finished consumer goods, but are at an intermediate stage of processing (Feenstra, 1998) and that is why, country-wise analysis for India's gross exports is done. Further, with India's rapid integration in the world economy post the 1991-92 trade liberalization, the impact of global financial crisis and subsequent slowdown in the world economy has impacted the trade balance of the Indian economy. Therefore, from policy perspective it

becomes important to assess the impact on export value from imported intermediates and from domestic value-added.

Our proposition is to study: (1) the trends and patterns of India's gross exports by breaking it down according to different end user category and capturing their destination markets. The purpose is to analyse the exports of intermediate goods using the informed classifications based on Sturgeon and Memedovic (2011), the module allows measuring a GVC-related performance. While analysing the trend, we check if the global financial crisis of 2008-09 significantly impacted the India's export of intermediate goods through an exogenous structural break test. (2) the extent of India's participation in GVC measured through various trade indicators<sup>3</sup>, along with analysing trend and pattern of India's sector-wise participation in GVC. The analysis allows determining India's domestic value addition and foreign value addition in exports of both final and intermediate goods while comparing it with estimates of technological intensity of India exports.

We find that India's participation in GVCs has stabilized after increasing over the years and is shifting towards downstream position for all the selected sectors. The ratio of foreign value added to domestic value added has increased after financial crisis in 2008-09, but, the strong dependence on domestic value addition can be seen in the increase in gross exports of both final and intermediate goods for the sectors from 2000 to 2011 level. The textile & footwear being a low-tech sector, has not been able to convert increasing DVA (Domestic Value Addition) into rising export share or the GVC participation rate. On the other hand, hi-tech sector, electronics & computer has been able to with increasing GVC participation and domestic value addition increase its export share.

The paper is organised as follows. Section 2 provides the literature review. Section 3 entails the construction of hypothesis. Section 4 gives the data methodology. In section 5, the trends and patterns of different end-user product categories in India's exports is described. Section 6 deals with trend and pattern of India's participation in GVCs. Section 7 finally provides with findings and conclusion of the study.

Section 2

## **II. Literature Background**

The outsourcing and offshoring simultaneously help the firm in three strategic needs: (1) 'efficiency' or cost reduction; (2) 'exploration' or access to knowledge and talented people; and (3) 'exploitation' or development of foreign markets (Dunning, 1993). But, with phenomenal improvements in communication infrastructure and significant cost reduction in global telecommunication, offshoring and outsourcing have reached new heights (Blinder, 2006; Levy, 2005), where along with standardized activities driven by cost savings and involving lower-skilled labour also includes more sophisticated and advanced activities like research, design, engineering, and product development.

India's edge goes beyond outsourcing as described by an article in New York Times, 2007, where India has been attracting white collared jobs in fields as diverse as investment banking, aircraft engineering and pharmaceutical research have begun flowing to India and a few other developing countries. "This is not a zero-sum game, in which every job added in India comes at the expense of an American or European one", Giridharadas (2007). This view was proved with many examples in leading daily newspapers and reports of MNCs and think tanks alike, Convergys (2011), Odgers Berndtson (2016) etc. Thus, India with its large population and multiple-skilled people is fast becoming a hub for both back and front-end outsourcing activities.

The literature capturing the countries participation in GVC is vast and is growing fast. The recent studies include the consequence of fragmentation of production on employment, welfare and income distribution. This section provides a brief literature overview. Trade in parts and components (P&C) has grown much faster than trade in final goods as intermediate products cross national borders multiple times during the production process (Feenstra, 1998, Hummels et al, 2001, Athukorala, 2012, Baldwin and Lopez-Gonzalez, 2013). The technological change has allowed in the last two decades a fragmentation of production that was not possible before. In certain industries, such as electronics and automobiles, this technological change has made it possible to sub-divide the production process into discrete stages. In such industries, fragmentation of production process into smaller and more specialised components allows firms to locate parts of production in countries which intensively use resources that are available at lower costs. But, the main reason why firms can fragment their production is that trade costs have significantly decreased. Transport and communication costs have decreased due to technological advances such as the container or the Internet. But, obviously as described by Jones and Kierzkowski (2001), the level of fragmentation depends on a trade-off between lower production costs and higher transactions/co-ordination costs. Thus, an optimal level of fragmentation needs to be ascertained.

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<sup>3</sup> The OECD-World Trade Organization (WTO) Trade in Value-added (TiVA) statistics (2016) is used for the analysis.

Also, there exists competing methods in literature which try to quantify the magnitude of fragmentation in global value chains. There are two major approaches followed in literature. The first approach is by Yeats (2001), where segregation of parts and components from final assembled goods using country specific UN-SITC data is done. However, the mapping of the GVCs done by Sturgeon and Memedovic (2011) for three often cited sectors electronics, automobiles and motorcycles, and apparel and footwear uses BEC, revision 3 classification from UN COMTRADE data for three end-use categories: capital, intermediate, and consumption goods. The second approach, proposed by Hummels, Ishii and Yi (2001) involves estimating the import content of exports (also termed as vertical specialization) using input-output transactions matrix. An augmented version of the first approach to ascertain the value addition was done by many authors (Yeats, 2001; Ng and Yeats, 2003; Athukorala and Yamashita, 2008; Kimaru, 2006; Athukorala, 2010, 2011; and Tiwari et al. 2013) to quantify the magnitude of trade in parts and components and final assembly which is termed as 'network trade' by using individual country trade statistics from UN Comtrade database. However, GVCs go much beyond the network trade, as mentioned by Banga (2013), all the activities under the production process, beginning from research and development activities, product designing, sourcing of primary products, production of intermediate products, final assembly of the product, packaging, branding and marketing of the product, etc are now being split and undertaken in different countries/continents.

The review of literature on value added trade covering India involves a number of studies based on network trade (Athukorala 2010, 2011; Athukorala and Menon, 2010; Sen and Srivastav, 2011; and Kimura and Obashi, 2010). Where it has been pointed out that among Asian countries, India has significantly low participation in international production network. However, according to them India has the potential to benefit more from this new form of international specialization in the future, given its relatively low-cost and trainable labor, and its location in a region that has become the world growth center for component production and assembly. In the case of India, Athukorala (2011) estimated that in 2010-11 the share of network products in total manufacturing exports of India was about 14 percent and it was much lower than that of most of the developing East Asian and ASEAN countries. This study further estimated that for the year 2010-11 the share of P&C (parts and components) imports was 22.9 percent which was larger than P&C exports at 10.4 percent thereby suggesting that in contrary to rest of Asia, India is more involved in procuring P&C for manufacturing of final goods rather than becoming a global production base for production of such goods. Banga (2013), using OECD WTO trade in value added (TIVA database) provides that the ratio of forward to backward linkages in global value chain for India and other developing nations like Thailand, Vietnam, Malaysia and Philippines is less than one, indicating negative value-added gains. A recent paper by Mukherjee (2018) analyses India's participation in global value chains after identifying its key traded sectors. While India's participation in value chains of key traded sectors has increased, it has varied across industries. India's participation has increased in more downstream stages in service sectors and textiles and footwear – and shifted to less value-added segments in some of the primary and manufacturing sectors.

A case study by Nag (2011) for auto component industry tries to analyze the policy challenges that restrict India from a greater participation in global value chains. He finds that India despite lowering tariff barriers and liberalizing the economy is mostly left out of Asian industrial production networks due to high trade cost and the complexities with multiple rules of origin in PTAs. On the other hand, Hoda and Rai (2014) point towards the lower participation in GVC due to insufficient trade infrastructure relating to logistics in terms of gateway of ports, road and rail connectivity and unavailability of uninterrupted power supply in industries. The limited stock of FDI in manufacturing sector is also a big problem.

The studies on measuring import content of exports, Dean, Fung and Wang (2007) by estimating the China's "vertical specialization", have concluded that the use of imported intermediate inputs in exported goods, increased between 1997 and 2002 in most industries. This is opposite to what most theories of development would predict, China increased its reliance on imported intermediates as exports increased. In the case of India, Goldar (2013) and Bhat and Paul (2009) find that import intensity of exports increased in the late 1990s as compared with early 1990s. (Goldar, 2013) concluded that this increase in the import intensity of exports is due to rising trend in fragmentation of production and increasing integration of India into the global value chains.

It is to be noted that studies mentioned above, focus on assessing import intensity of exports or the overall magnitude of import content in exports for India rather than explaining for the disaggregated sector/industry level trends in domestic and foreign value added in exports. There are in fact very few detailed industry level studies for India. Thus, the present study attempts to improve over the previous studies in the following ways-

First the study tries to decipher if the deterministic causal linkages between export-led industrialization, the technological content of exports, and industrial upgrading have led to changes in technology intensity of Indian domestic content in exports as much as the gross export value is implied by the data. This is done by using OECD-WTO-TIVA database. Secondly, by taking each sector from a different technology-intensive category and comparing the domestic value addition and foreign value addition of final and intermediate goods,

we delve deeper to understand, how only estimating the final value of technology intensive exports can be a misleading phenomenon for a sector.

### **III. Hypothesis Development**

Between September 2008 and mid-2009, global trade suffered a sudden, severe, and synchronized collapse. Yi (2009) suggests that vertical specialization provides a real transmission mechanism that can help explain the widespread decline in trade. Because growing vertical specialization leads to more cross-border transactions occurring between separate stages of the production process Feenstra (1998) and due to the notion of “bullwhip” effects of recessions and business cycles, the slowdowns and downturns impact material, parts and component shipments more than final goods. Thus, the first hypothesis relates to the structural break in the trend of India's exports of intermediate goods to the world. In the “The Great Recession and India's trade collapse”, Kumar R & Alex D. (2009), through descriptive data analysis prove that the export of intermediate goods being a part of merchandise exports during the period were impacted from growth in real world GDP. India did suffer “second round” effects when the financial meltdown morphed into a worldwide economic downturn. Because the economies are increasingly characterised by vertical specialisation resulting in a major expansion of intra-industry trade, amplified the contagion during the crisis.

#### **H1: There exists no exogenous structural break in export pattern of India's intermediate products during the period 1990 to 2015.**

The rise in GVCs itself being the cause of increase in trade, led many researchers to study import content of India's exports. Based on input-output tables using “Vertical specialization” indicator (VS for short), originally proposed by Hummels, Ishii and Yi (2001), for analysis of value-added trade, has also been considered as a useful proxy indicator to illustrate a country's degree of participation in vertical specialization of trade. Chen, Cheng, Fung and Lau (2004), Koopman, Wang and Wei (2008), Dean, Fung and Wang (2007), among others have undertaken studies on determining the domestic value-added content of China's exports for different time periods and have concluded that China's increased reliance on imported intermediates led to increase in gross exports. Another research paper by R Upward, Z Wang, J Zheng (2010) analysing the Chinese export boom of 2000-07 provides that estimates of technological intensity show that Chinese exports had been increasingly intensive in technology, but the overall intensity was lower when the exports were evaluated by domestic value-added than by final value. On the same lines, the second hypothesis tests the data for the Indian scenario.

#### **H2: The rise in import content of India's exports has led to increase in value of gross exports during the period 2000 to 2011.**

We break down this hypothesis further to check if the exports of intermediate and final goods of the chosen sectors depend more on foreign value addition than on domestic value addition.

### **IV. GVC Statistics and Methodology**

This module uses the UN Comtrade data on gross exports and imports to construct the trade data of intermediate, capital and consumer goods. Using the informed classifications based on Sturgeon and Memedovic (2011), the module allows measuring a GVC-related performance.

The next data set used is OECD-World Trade Organization (WTO) Trade in Value-added (TiVA) statistics which has come to be used extensively in the evolving global value chain literature. In our study, we seek to examine the following: After selecting the technology intensive sectors according to the OECD classification (2011), namely, electronics, automobiles and motorcycles, and apparel and footwear, we examine their domestic value-added content in India's export and value chain participation.

Combining our results from the domestic value-added share of exports and India's participation in GVC across industries, we are able to infer changes in India's domestic value-added share in exports and how it has been impacted by India's changing GVC participation.

The extent of value chain participation and possible movements towards downstream stages are analysed next. The gross exports of every sector are divided into export of intermediate and final goods. Their export trend is also analysed. This is followed by comparing the situation in India with the world average trends. In doing so, we look at two key indicators:

1. **Forward Participation Index (FPI):** This is the share of exported goods and services used as imported inputs in producing the importing country's exports (Koopman, et al 2010).
2. **Backward Participation Index (BPI):** This index measures the value of imported inputs in the overall exports of a country for the particular industry (Koopman, et al 2010).

The statistics of the indicators as well as GVC participation are sourced from OECD-WTO TiVA 2016. This part of the analysis, using OECD TiVA 2016 indicators, furnishes data up to 2014 (TiVA Nowcast). But certain indicators are still undertaken according to the data up to 2009.

To analyse if India's growing GVC participation is due to higher backward or forward participation, we construct a ratio of BPI to FPI. This ratio would help us deduce whether India depends on greater foreign inputs for production (higher values of the ratio) or is increasingly becoming a primary input supplier (lower values of the ratio). For sectoral analysis, the rise in import content of gross exports of final and intermediate goods is correlated with the ratio of FVA (Foreign Value Addition) to DVA (Domestic Value Addition), in order to ascertain if the import content in gross exports enables in its increase in the world. In our inferences we must be careful that production networks and fragmentation in production have changed across our time frame of analysis.

## V. Trends of India's Exports divided into end-user categories

### 5.1 Examining exports of intermediate goods

Technology intensive and skill intensive exports can be taken as a proxy for value added exports (Prasad, 2017). At present share of high-technology exports in India's manufactured exports is only 7.24 per cent (in 2015) whereas for the same year it was 34.4 per cent in China, 54.8 per cent in Singapore, and 34.2 per cent in South Korea (Appendix). Another way of looking at value added exports is by seeing the exports of products, by stage of processing (Table-1). India's exports by stage of processing in 2015, shows a greater share of consumer goods and intermediate goods. For countries like Hong Kong, and Singapore, the share of capital goods in total exports is the maximum. Same is the case for Japan, USA and even China. China has moved up the value chain of technology products while having a share of 43.7 per cent of high-technology manufactured goods exports from Asia itself in 2014 (ADB, 2015). Thus, India needs to move up in the value chain in order to increase its exports value.

**Table 1: Different countries export of products by stage of processing**

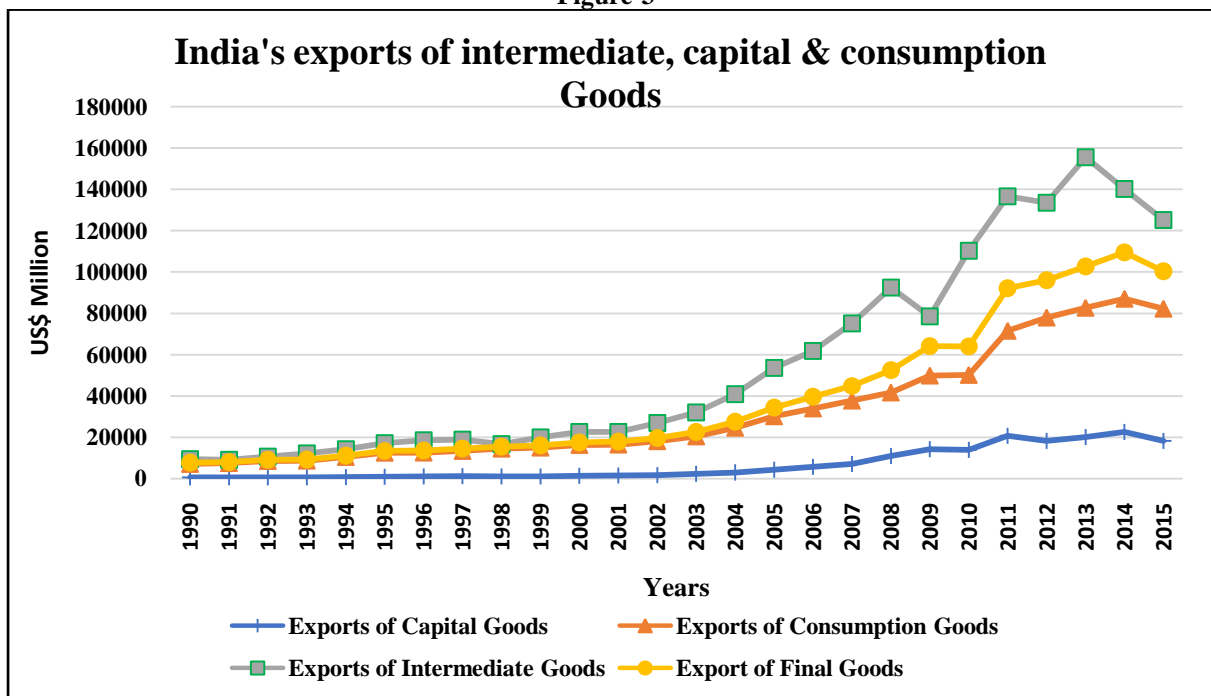
Product Categories	China		India		Japan		USA		UK		Singapore	
	Exports (US\$ Bn)	Share (%)	Exports (US\$ Bn)	Share (%)	Exports (US\$ Bn)	Share (%)	Exports (US\$ Bn)	Share (%)	Exports (US\$ Bn)	Share (%)	Exports (US\$ Bn)	Share (%)
Raw Materials	38	1.7	21.8	8.3	8.2	1.3	136.4	9.1	30.3	6.5	3	0.9
Intermediate Goods	365.6	16	86	32.5	130	20.8	296.3	19.7	122	26.2	58.4	17
Consumer Goods	831	36.4	117.3	44.4	155.8	25	384.6	25.6	169	36	85	24.5
Capital Goods	1008	44.2	36.4	13.8	290	46.4	514.4	34.2	128	27.5	179	51.6

Source- Data taken from UN-COMTRADE

### 5.2 Trends and Patterns

For the better analysis of GVC pattern, we have combined the capital and consumer goods into one final goods category and then have compared with India's exports of intermediate goods. The following points need mention. First, trade in intermediate goods appears to be much more volatile than trade in either capital or consumption goods. The bullwhip effects of recession and business cycles have impacted parts and components more than final goods because producers of final goods tend to draw down parts inventories and delay re-ordering during and directly after periods of uncertainty (Escaith et al, 2010). In addition, the growth in intermediate goods picked up after world recession of 2008-09 more than growth in capital and consumption goods (Figure-3). The cutbacks on spending and retrenchment of expansion plans due to the uncertainty in global demand leads firms to outsource their activities in such a way that minimal fixed cost is incurred. Also, knowing the fact that countries specialise in specific stages of production, exploiting the comparative advantage by the providers of outsourcing activities becomes all the more necessary.

Figure-3

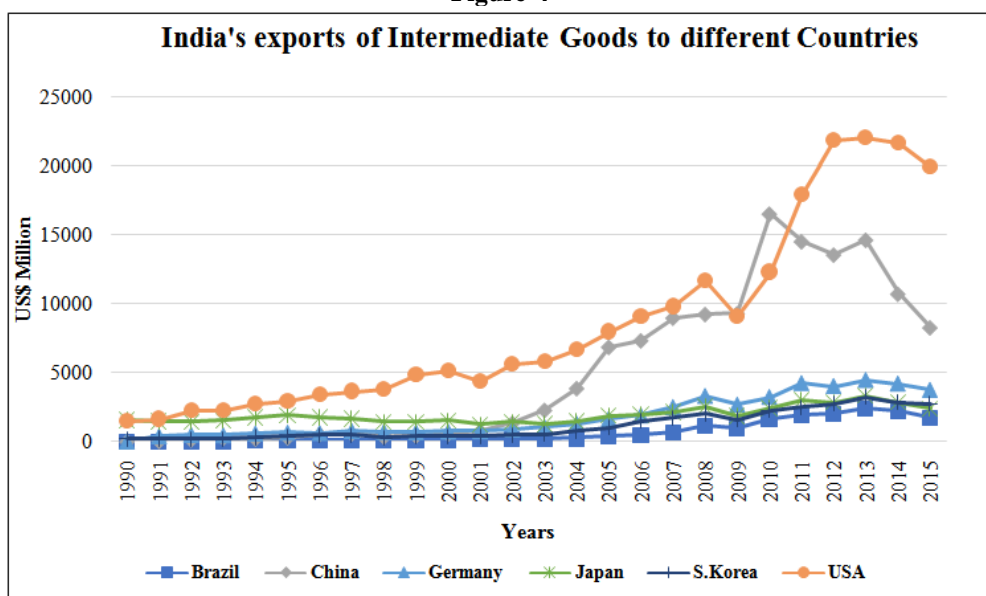


Source- Calculated from WITS UN-Comtrade

Outsourcing by US and China companies has been one of the most important drivers of GVC expansion for India as can be seen in the Figure-4. Secondly, as the business cycles continued toward new peaks, firms started building on successful outsourcing experiences given insufficient time to install new internal capacity to meet increasingly growing demand (Sturgeon, 2003). Thus, as concluded by (Sturgeon and Memedovic, 2010) “in good times and in bad, outsourcing and offshoring tends to become more common” represents the imperative behind countries depending on other countries for increase in profitability during times of uncertainty.

When the data is analysed the value and growth rate of intermediate goods trade is quite similar to trade in final goods but with a lag and softer peaks and troughs. Thirdly, when consumption and capital goods are considered separately, trade in intermediate goods contributed more than trade in final goods did to the growth of total manufacturing trade (exports).

Figure-4



Source- Calculated from WITS UN-Comtrade

### 5.3 Test for Structural Break

The time period of analysis taken from 1990 to 2015, provides insights based on both external and internal factors about the growth of India's manufacturing exports in general and exports of intermediate goods in particular. The rise of global supply chains means that intermediate goods cross borders many more times than they did in a world where most stages of production took place within one country. This reasons out as to why trade volumes decline more sharply than output during downturns and why trade accelerates faster than GDP when the economy picks up. As stated by World Trade Statistical Review (2017), since the Second World War, the volume of world merchandise trade has tended to grow about 1.5 times faster than world GDP, although in the 1990s it grew more than twice as fast. However, in the aftermath of the global financial crisis the ratio of trade growth to GDP growth has fallen to around 1:1.

One of the core reasons for the sharp fall in India's exports is the high-income demand elasticity for exports which makes exports highly sensitive to GDP movements. India's exports have been found to be more sensitive to income than to price changes. The income elasticity of demand for India's exports has been found to be highest for the US (2.5) while, for India's global exports, it is estimated at about 1.9 (UNCTAD 2009). This is consistent with the fall in the US' share in total Indian exports from 2008-09.

The recession of 2008 has resulted in a sudden pivot in the trend (Figure-5). Being volatile with sharp edges, the structural break test analyses if the exogenous break point of 2008 led to instability in the real exports of India's intermediate products.

The dummy variable alternative to Chow Test has been used to determine the stability of the variable. The relationship relates to exports of real intermediate goods and real-world GDP over the period 1990-2015. We divide the sample period into two parts, 1990-2008 and 2009-2015.

$$Y_t = \alpha_t + \alpha_2 D_t + \beta_1 X_t + \beta_2 (D_t X_t) + U_t \quad \dots(1)$$

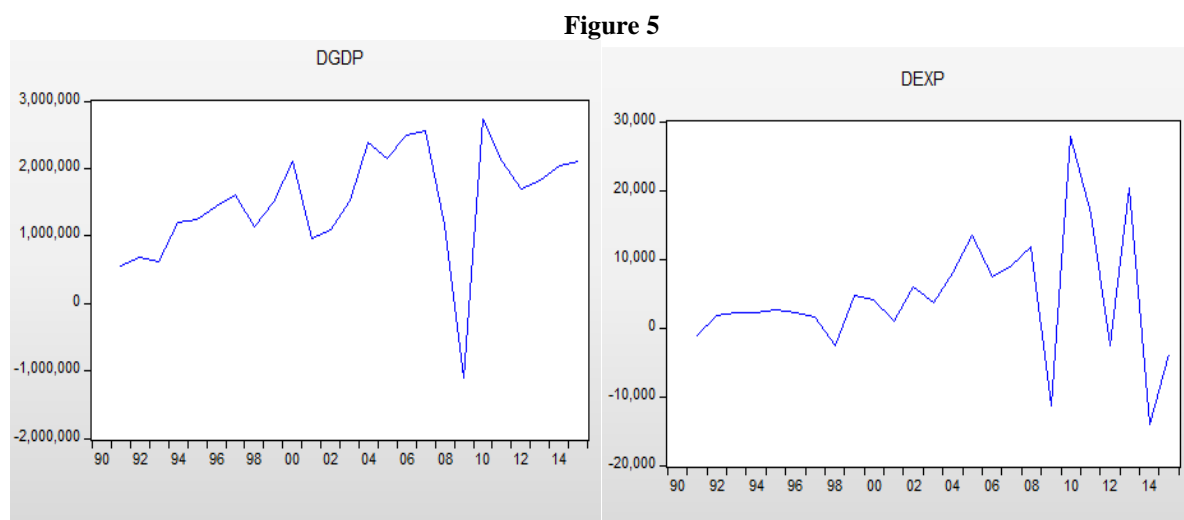
where Y = Exports of Intermediate goods deflated by price-level

X = World GDP deflated by price-level

t = time

D = 1 for observations in 2009-2015

= 0, otherwise (i.e., for observations in 1990-2008)



The time series of both these variables becomes stationary by taking a first difference. The graphs above depict the stationary series. The equation (1) when regressed shows that there is no structural break. Neither dummy intercept nor dummy slope coefficient brings about any change in the model. Thus, the break-point year taken as 2008 doesn't reflect any change in the structure of India's export of intermediate goods to the world. We, therefore accept the null hypothesis that there exists no structural break in the data.

The figure-5 above presents India's real export of intermediate goods and world's real GDP value both of which are one-year differenced. Countries with extensive export-led model of growth, as in many South-East Asian countries, and that depended upon commodity exports, were more severely affected by the financial crisis of 2008. Also, these were the countries highly correlated with the US growth cycle over the last decade.

Thus, India may have been unaffected from the 2008 global financial crisis, but its vulnerabilities have since increased as the data showed a structural break from 2012 onwards. The study on the impact of financial crises by Reinhart and Rogoff (2008b) tries to sum up by noting that, "Broadly speaking, financial crises are protracted affairs". The Reserve Bank of India (RBI) Governor D Subbarao (2009) pointed out that since India's merchandise exports account for less than 15% of gross domestic product (GDP), the trade channel impact was



assumed to be bearable. However, due to increase in global uncertainty, weak industrial growth, slowdown in investment activity, slide in the rupee and deceleration in the resource flow to commercial sector, a dip in output growth was witnessed during 2012.

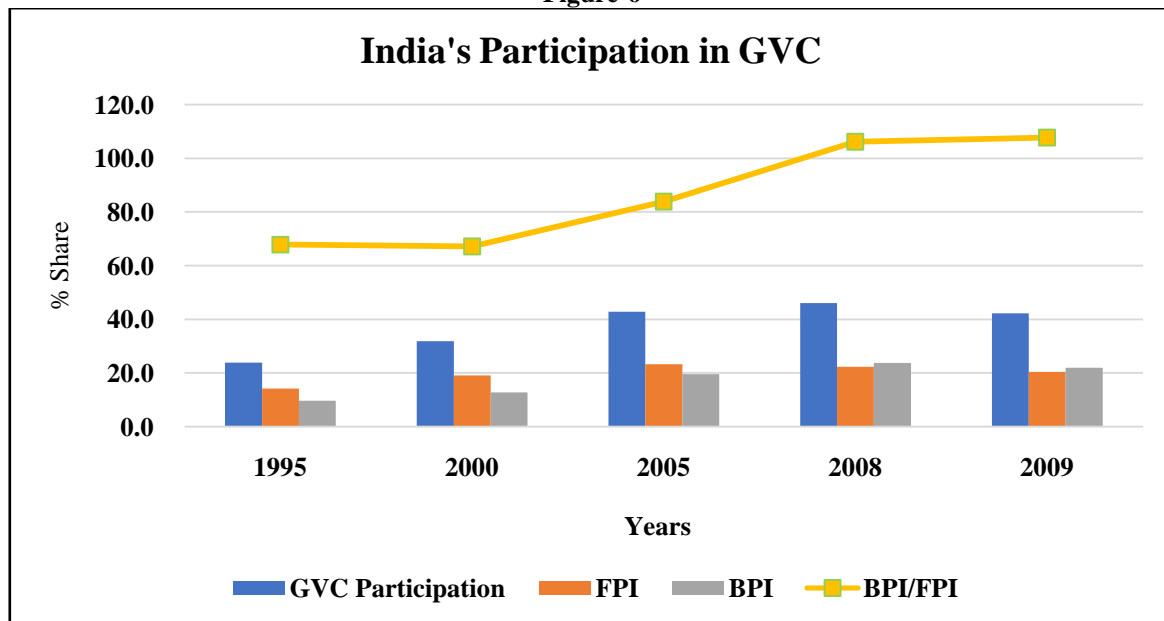
## VI. Trends in value added content in India's Exports

### 6.1 India's Participation in Global Value Chains (GVCs)

After seeing the trend for general intermediate goods export by India to world, we investigate India's participation in value chains focusing on what is the share of exports involved in a vertically fragmented production process. According to OECD-WTO's TiVA database, India's GVC participation index stands at 42.3, as compared to 52.3 for Vietnam and 60.4 for Malaysia in 2009. The GVC participation index, while considering both goods and services, displays a country's integration into the global value chains and is the sum of forward and backward linkages divided by total exports. This part of the analysis, using OECD-WTO TiVA 2013 indicators, furnishes data up to 2009. Hence our analysis in this part covers the period from 1995 till 2009.

India's growing GVC participation providing a link between use of imported inputs and intermediate goods in exports supplemented with BPI/FPI ratio helps in deducing whether India depends on greater foreign inputs for production (higher values of the ratio) or is increasingly becoming a primary input supplier (lower values of the ratio) for each industry. As can be seen in the figure-6 below, this ratio has been rising from 2000 to 2008. And, since 2008 it has become flat. This only shows to prove that with increase in GVC participation, India has been relying more on foreign inputs for its exports.

Figure-6



Source-OECD-WTO GVC (2013) Database

### 6.2 Sector-Wise Analysis of India's Intermediate and Final Goods Trade

After seeing the trend for general intermediate goods export by India to world, the three goods producing industries which are important in driving the growth of GVCs: electronics (broadly defined), passenger vehicles (including motorbikes), and apparel (including footwear) are undertaken for a customised sector-wise analysis, where the products are aggregated within the BEC classification. We investigate India's participation in value chains focusing on its exports and exploring the changes in stages of value chain participation for these export sectors of India.

In general, product development, research and development (R&D) and the final stages of production accrue to most value-addition. Hence, participating in these stages of production through exports yields the greatest gains from trade. But, for developing economies, participating in skill-intensive R&D and designing stages is difficult if the industry itself is not present in the country. However, participation in the production process i.e. upstream participation in the phase of supplying raw materials or semi-processed intermediates is an easier option to reap benefits from trade (Mukherjee, 2018). The Organisation for Economic Co-operation and Development (OECD) has shown that developing countries participating in growing global value chain (GVC) have a gross domestic product per capita growth rate of 2% higher than the average.

### 6.2.1 Trends and Patterns

For a developing country like India to maximise gains from exports in a world of trade characterised by value chains, it is ideal to be participating in the chain for selected products groups- for example, upstream because of the expertise in R&D, system design and downstream because of the low-end segment of manufacturing providing jobs and going further in the chain on account of being a large market.

India has been a part of various value chains with growing relevance in the automobile industry and there are studies on local content requirements and conflicts with the European Union and the United States on these issues (Bagwell & Sykes, 2005).

The shares of various sectors in India's gross exports are reflected in Table-2. About 35 to 25 per cent of India's exports from 1995 to 2014 were accounted by three sectors, namely, textiles, textile products and footwear (share declined from 31.2 per cent to 15.4 per cent); computer, electronic and optical equipment (share increased from 3 per cent to 4 per cent) and motor vehicles, trailers and semi-trailers (share increased from 2 per cent to 4.5 per cent).

**Table-2 Sector Shares in India's Exports to the World**

Industry	1995	2000	2010	2015
Textiles, textile products, leather and footwear	31.2	30	12.5	15.4
Computer, Electronic and optical equipment	3	3	4.7	4
Motor vehicles, trailers and semi-trailers	2	1.6	3.9	4.5

Source- UN-Comtrade data

If we look at India's domestic value-added (DVA) as a fraction of gross exports between 2000 and 2014 in Table-3, the value-added has dropped from 84 per cent to 79 per cent in the aggregate, which implies greater use of foreign inputs in India's production in general over the years in spite of India being a large economy rich in labour and other natural resources. The impact of financial crisis of 2008-09 led DVA as a share of gross exports to fall in totality. But, sectors like textiles & footwear and computer & electronics witnessed an increase in share of DVA from 2010. However, the sourcing of foreign inputs is inextricably tied to developing domestic value added for exports (OECD, Trade Policy Note, 2016).

The domestic value-added has increased from 74 per cent to 83 per cent between 2000 and 2014 in textiles and footwear exports; from 61 per cent to 74 per cent for computer, electronic and optical equipment. Both these sectors have relied more on domestic value addition over the years. The higher import content in exports leads to greater vertical specialization, thus, allowing for greater GVC participation. This case is true for motor vehicles, trailers and semi-trailers sector as the domestic value added decreased from 78 percent in 2000 to 69 percent in 2014. But since its share in India's total exports has shown a declining trend from 2010, we would need to check if its exports may be further used in production elsewhere or be consumed by a final consumer. We examine this in more detail in the value chain participation indicators below.

**Table- 3 Domestic Value-added Share of Gross Exports**

Industry	2000	2005	2010	2014
Total	84	82	81	79
Textiles, textile products, leather & footwear	74	73	74	83
Computer, Electronic and optical equipment	61	57	55	74
Motor vehicles, trailers and semi-trailers	78	65	64	69

Source-OECD-WTO TIVA (2016) Database

GVC participation being the sum of backward and forward linkages divided by gross exports, India's participation for all the sectors has tended to increase over the years from 1995 to 2009 (Table-4). Signifying higher vertical specialization. Though, India's GVC performance has improved due to its GVC participation by few industries not included here, namely, manufacturing nec, recycling transport equipment; machinery and equipment; basic metals and fabricated metal products. But the performance of the textiles & footwear, computer & electronics and Motor Vehicles have also contributed to increase in India's GVC participation over the years. However, only the textile sector has shown decline in GVC participation and a rise in domestic value-added share in total exports from 2005.

**Table-4 GVC Participation**

Industry	1995	2000	2005	2009
Total	24	32	42.8	42.3
Textiles, textile products, leather and footwear	3.2	3.5	2.7	1.9

Computer, Electronic and optical equipment	0.5	0.6	0.9	1.3
Motor vehicles, trailers and semi-trailers	0.3	0.4	0.7	1.1

Source-OECD-WTO GVC (2013) Database

But we are mainly interested in value creation, although participation has increased in computer, electronic & optical equipment and motor vehicles, trailers and semi-trailers sectors, the benefits in terms of gaining through exports may have been limited.

While the above analysis gives us an idea of India's sectoral participation in GVCs, the relative movements upstream and downstream can be deduced from the ratio of BPI to FPI. The increase in BPI to FPI ratio would imply increasing dependence on foreign inputs or lower usage of a country's exports in trade partner's exports opposed to the usage of domestic inputs for final exports implying probable downstream movements. FPI could be low when major exports of a sector are directly consumed as final demand.

**Table-5 Ratio of Backward to Forward Participation**

Industry	1995	2000	2005	2009
Total	0.68	0.67	0.84	1.08
Textiles, textile products, leather & footwear	1.62	1.8	2.25	2.33
Computer, Electronic and optical equipment	0.99	1.1	2.18	2.38
Motor vehicles, trailers and semi-trailers	3.84	2.44	3.29	4.44

Source-OECD-WTO GVC (2013) Database

The Table-5, shows how India's production has moved more downstream as reflected by an increase in the BPI to FPI ratio from 0.68 in 1995 to 1.08 in 2009. It also shows that while India was participating more as a source of intermediate products for its trade partners in 1995, it has now become a significant importer of semi-processed intermediates. The all three sectors stand out in terms of increasing foreign inputs more than their exports being used as intermediates elsewhere.

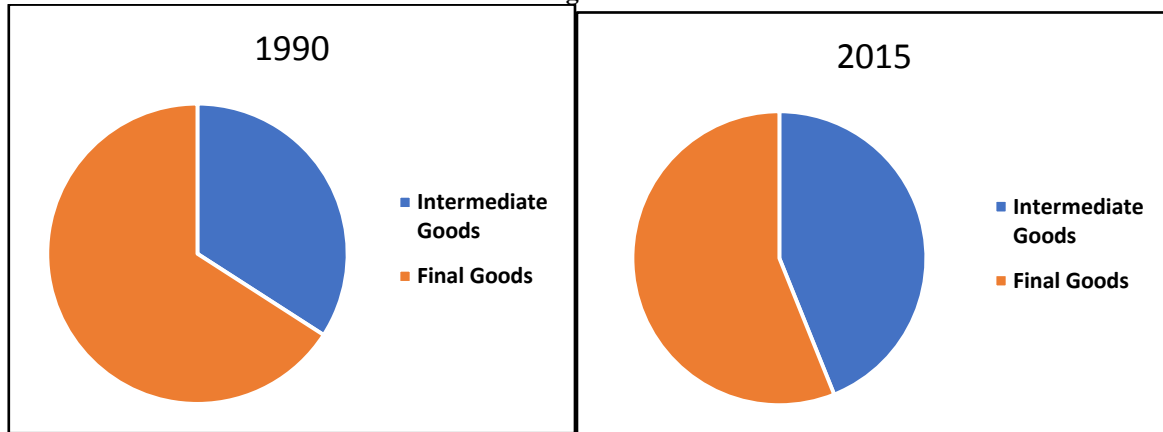
Next, knowing the fact that India's GVC participation is going towards downstream, we check for the contribution of domestic value addition and foreign value addition in the intermediate and final goods to provide further insight on the dependence of the countries on India and vice-versa. We, thus evaluate a ratio of foreign value added (FVA) to domestic value added (DVA) in India's export to world of final and intermediate goods. The higher the ratio, the greater the dependence of India on foreign inputs in exporting either intermediate or final goods.

#### **a) Textiles, Textile Products, Leather & Footwear**

Textiles and clothing (T&C) industry has been a significant contributor to the early successes of most of the Asian countries as well as to the development of their distinct value chains. Many late-comer countries acquired prominent positions in the global value chains (GVCs) owing to this industry, such as, Vietnam, Cambodia, etc.

India's gross export of intermediate products relative to final products is presented in the figure-7 below, where in 2015, total gross exports of textile, leather & footwear is around US\$ 16 billion, of which 56% are final goods and 44% are intermediate goods. The share of intermediate products has increased in 2015 from 1990, leading to greater export competitiveness. The gross exports of apparel and footwear have increased in general by over 500%. The United States and China are the main destinations. In 2000, India's exports to China and USA was 16 & 13 per cent, respectively. In 2015, the share going to China was 42 percent and to USA was 10 percent.

Figure-7

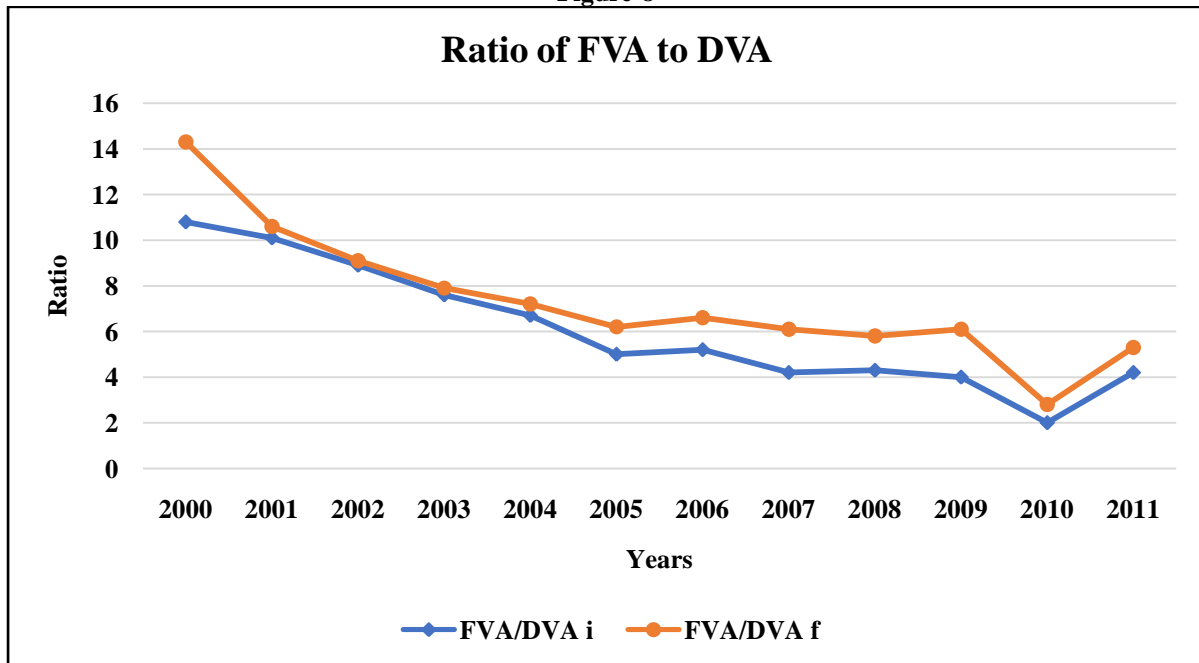


Source- UN-Comtrade data

India's apparel and textiles industries are vertically integrated, and include a domestic raw cotton material base. However, using India's Input-Output Tables (IOT) of 1993-94, 1998-99, 2003-04 and 2007-08 (as obtained from Ministry of Statistics and Programme Implementation, Government of India), Gupta (2015) has shown that vertical specialization index for Indian textile and clothing industry has been around 17% in 2007-08 which is quite low. But this has increased from much lower levels. The domestic value addition continues to be very large, above 80%.

Comparing the gross exports with the value addition for final and intermediate goods, reveals that from 2000 to 2011, the ratio of FVA to DVA for both final (FVA/DVA f) and intermediate (FVA/DVA i) goods for the textile and apparel sector has steadily declined, which implies that India is dependent on domestic capabilities to achieve economic competitiveness. However, the impact of financial crisis has led to increase in FVA in both the goods (figure-8).

Figure-8



Source-Author's own calculation using OECD-WTO TIVA database (2016)

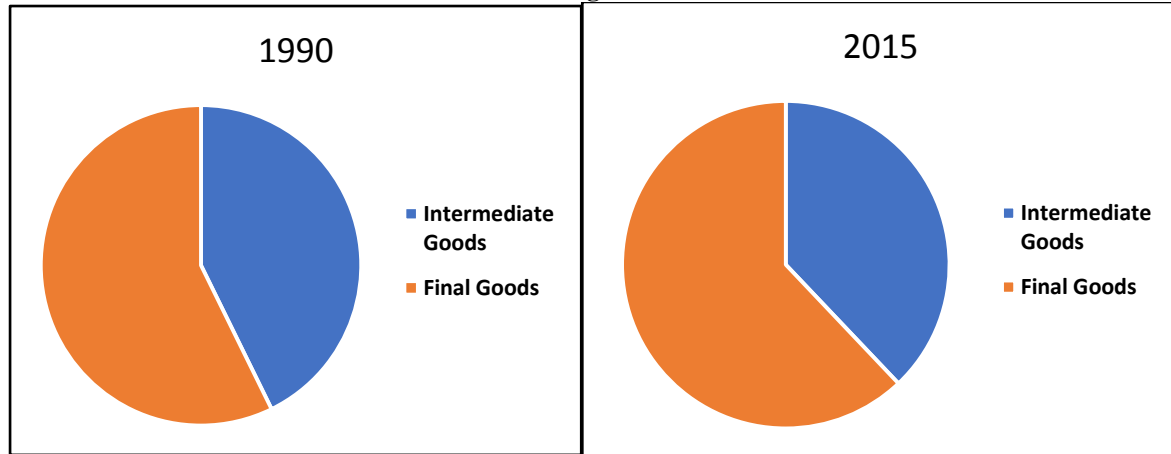
#### b) Computer, Electronics & Optical Equipment

Electronics is considered to be the largest and fastest growing industry worldwide with annual global production touching nearly US\$ 2 trillion in 2014-15 and is expected to reach USD 2.4 trillion by 2020. India has less than 1% share in the global electronics markets<sup>4</sup>. In 2015, total gross exports of computer, electronics

<sup>4</sup>NITI Aayog Report on Make in India Strategy for Electronic Products (2016)

& optical equipment is around US\$ 4.6 billion, of which 62% are final goods and 38% are intermediate goods. The United States, China and Singapore are the main destinations, although shares vary from year to year. For eg. In 2000, 18 per cent went to the US, 15 per cent to the Singapore and China's share was only 6 per cent and in 2015, 45 per cent goes to the China, 7.6 per cent to the US and 5.6 per cent goes to Singapore.

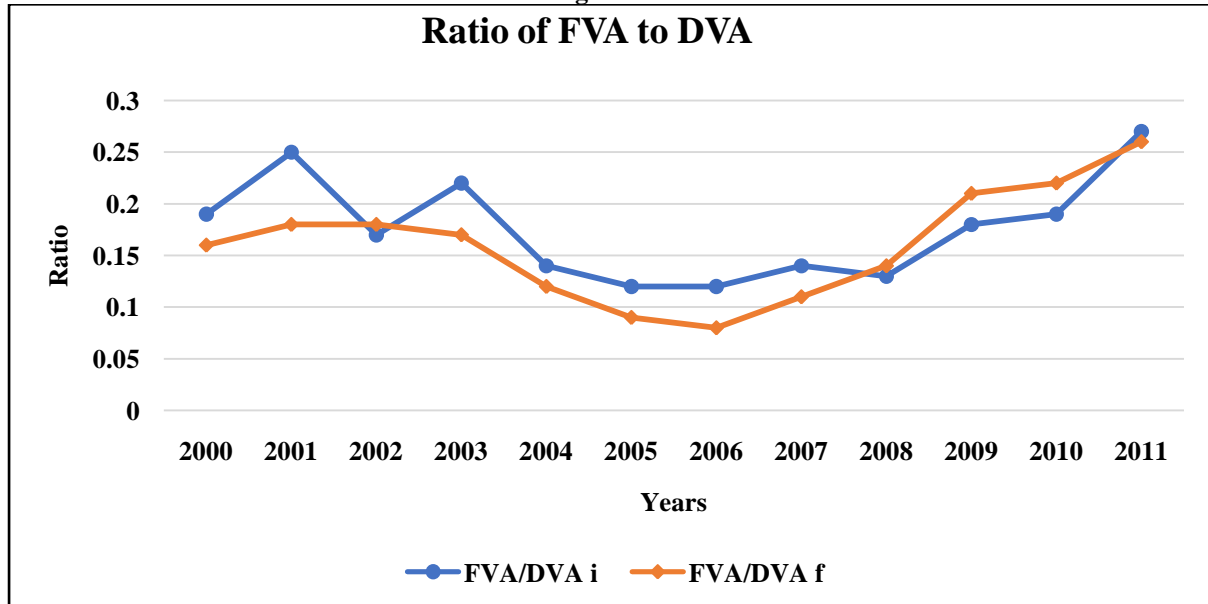
Figure-9



Source- UN-Comtrade data

The exports of final goods in 2015 has increased relative to intermediate goods when compared from 1990 level (figure-9). Comparing the gross exports with the value addition for final and intermediate goods, reveals that from 2000 to 2011, the ratio of FVA to DVA for intermediate products has been more volatile. Comparing with final goods export, it has had more foreign input up till 2008. But with increase in gross exports of final goods in 2015, the foreign value addition has also increased.

Figure-10



Source-Author's own calculation using OECD-WTO TIVA database (2016)

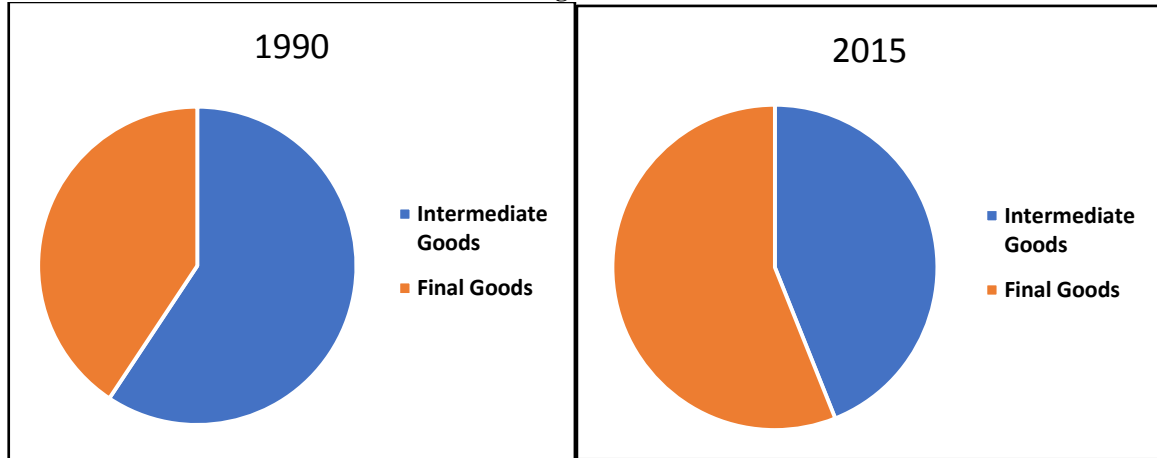
The impact of dot com bubble during early 2000's can be seen in the decline of the ratio resulting in increase of DVA in the production of final goods. But the ratio picked up after 2007 leading to increase in FVA in the production of both final and intermediate goods.

### c) Automobile and Motorcycle

The industry (vehicles and components combined) has been a capital-intensive industry, bearing the merit of having a mature supply chain & value chain. India is among the top 20 world producers of vehicles and has continually increased its production over the period 2004-14 (OECD, 2016).

The figure below presents the amount of dynamism the gross exports of intermediate and final goods went through over the years, reaching US\$ 15 million in 2015. The share of intermediate goods has decreased in 2015 in total export to world. South Korea, Germany, China and Japan have been the major destination having share of 20, 19, 14 and 8.5 percent, respectively in 2015.

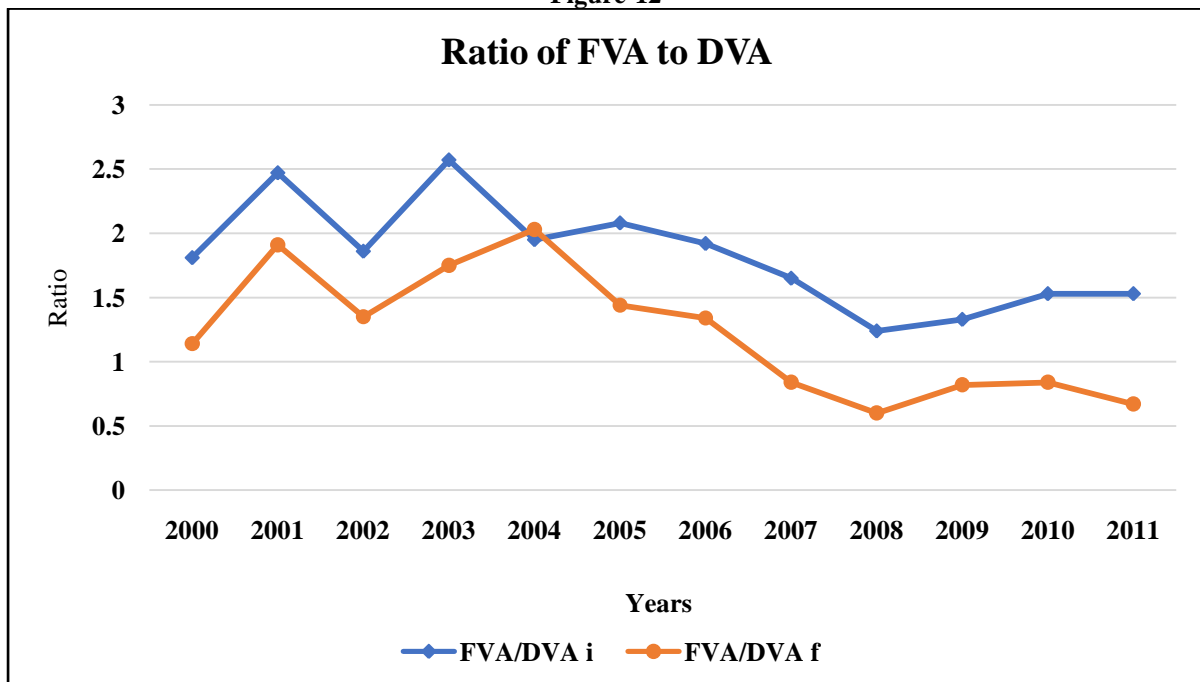
Figure-11



Source- UN-Comtrade data

The ratio of FVA to DVA being higher for intermediate goods than for final goods indicates the dependence of this sector on world inputs for India's further exports. Now, we can see that even though the gross exports of intermediate goods have decreased in 2015, the contribution of domestic value addition has also decreased. The ratio for both final and intermediate goods rises after a long fall in ratio from 2004 to 2008.

Figure-12



Source-Author's own calculation using OECD-WTO TIVA database (2016)

## VII. Findings and Conclusion

Table-6

Variables	High Tech Computer, Electronics & Optical Equipment	Medium High Tech Automobiles & Motorcycles	Low Tech Textiles, Textile Products, Leather & Footwear
GVC Participation	Exports have increased (+)	Exports have increased (+)	Exports have decreased (-)

<b>Ratio of BPI/FPI</b>	Exports have increased (+)	Exports have increased (+)	Exports have decreased (+)
<b>Ratio of FVA/DVA</b>	Exports of final goods have increased (+) Exports of intermediate goods have decreased (+)	Exports of final goods have increased (-) Exports of intermediate goods have decreased (-)	Exports of final goods have decreased (-) Exports of intermediate goods have increased (-)

The table provides a summary of the data presented above, being considered from 2000 to 2011. The variables' influence on the technology intensive sector is given in the bracket with increase or decrease in exports. For the high-tech sector, with increase in India's participation in GVCs, exports have increased. And this increase relates to increase in import content of exports, specifically for final goods. Almost similar case is seen for medium high-tech sector, but for increase in exports of final goods the ratio of FVA to DVA has decreased. For low tech sector, a different story is seen, the exports of textiles and footwear have decreased and the participation in GVCs has also decreased. Even then, there is a rise in import content measured by the ratio of BPI to FPI. For both final and intermediate goods, ratio of FVA to DVA has decreased.

The overall intensity of technology in exports can be lower when the exports are evaluated by domestic value-added than by final value. This is what China was facing during its export boom of 2000-07. India's gross export of textile, apparel & footwear, electronics & computer and motor vehicle during the period 1990 to 2015, has increased but the ratio of BPI to FPI has also increased (highly correlated). Showing the dependence on foreign inputs and producing final goods than highly valued intermediate inputs. We also estimated the correlation between ratio of FVA to DVA (intermediate and final goods) and the gross exports of both intermediate and final for the chosen sectors. This correlation came out to be significantly negative except for final goods of electronic and computer sector.

Thus, the data on ratio of FVA to DVA for the sectors shows that its mainly the contribution of domestic value addition in improving and sustaining the competitiveness of gross exports of either final or intermediate goods. The benefit of participating in GVCs has enabled local firms to take advantage of specialized knowledge garnered through participation in GVCs to export or set up production abroad, either directly or through contractors and suppliers.

In this paper, we analysed India's export of intermediate products relative to final goods for the period 1990-2015. The trends and patterns of goods reveal that trade in intermediate goods appears to be much more volatile than trade in either capital or consumption goods (clubbed as final goods) due to the bullwhip effects of recession and business cycle. But the financial crisis didn't have any effect on India's exports of intermediate goods to world as there was no structural break in the data. The GVCs emerging due to fragmentation of production processes across countries and continents and in the process have led to a faster rise in trade of intermediate products as compared to finished products. Outsourcing by US and Chinese companies has been one of the most important drivers of GVC expansion for India.

India fails to move up the value chain, that is, even with increase in GVC participation, India relies more on foreign inputs for its exports, shown by the rising ratio of BPI to FPI. However, the empirical research has shown that access to a range of competitively priced foreign intermediate goods has been crucial to achieving higher productivity in both industrialized countries and recent developers such as India and China (Miroudot et al, 2009; Goldberg et al, 2008). Also, many MNCs coming to India with efficiency-seeking motive might be using higher domestic inputs for producing goods for final consumption, which can also lead to higher ratio.

The sectors analysed in this paper account for 35 to 25 percent share of India's total exports between 1990 to 2015. We find that the domestic value-added in exports of most sectors has decreased systematically over the same period. But, for textiles & footwear (low-tech sector) and computer & electronics (high-tech sector), the DVA has increased. However, it is misleading to focus only on seeking a higher share of domestic value added; what actually matters is the total value that the economic activities within the value chain can generate. The increase in export share brought about by the increase in DVA can commensurate production-linked gains like employment generation, technology upgradation, skill development etc. Only computer and electronics sector in our analysis fits in the above explanation, that is, gains were larger for hi-tech sector. Also, higher exports from a country can no longer be linked to higher production in the country as imports of intermediate products which are used in exports may rise with little domestic value addition. This case is true for motor vehicles in our analysis.

Also, the sectors having maximum export are also the sectors where India has participated more in GVCs. This is true for computer & electronics and motor vehicles (true for high and medium-tech sectors). Delving deeper to understand if India participates more in the value-added downstream segments of production or is moving more upstream in the chosen sectors, we ascertain the ratio of backward participation to forward participation. We find that all three sectors stand out in terms of having higher ratio, increasing share of foreign inputs in India's exports than its share of exported goods being used as imported inputs in producing the importing country's exports. This, leads us to conclude that more goods are exported from India to meet the

final demand of other countries by making India more of an assembling country rather than exporting higher value-added products. Thus, India is going towards downstream movements. And, the hypothesis of increase of foreign value addition leading to increase in India's gross exports is not rejected as the correlation between the ratio backward participation to forward participation index and gross exports has come out to be significantly positive. But, when this hypothesis is broken to check if import content measure by the ratio of FVA to DVA for both final and intermediate products of different technology intensive sectors enables in increase in exports, the correlation comes significantly negative, thus conjecturing a sort of a contradiction.

As DVA in gross exports includes both direct value-added and indirect value-added, the latter getting included in forward participation, this only shows to prove that although the correlation between the ratio of FVA to DVA with exports of both intermediate and final goods for the different sectors concerned comes out significantly negative, India with its increasing participation in GVCs is a mere assembler of goods that catering to the final demand of the importers.

Although, "linking into GVCs" is being considered as the new development challenge by policymakers. But, linking into GVCs per se may not bring automatic gains. In fact, linking at the lower end in GVCs by exporting raw materials has "locked-in" many countries at the bottom of GVCs, especially commodity exporting countries as they continue to export low-end and low value-added inputs with lower gains in terms of domestic value addition (Gereffi 1994; Kaplinsky 2005; Milberg and Winkler 2012). The need to develop domestic infrastructure and competitiveness in certain segments of value chains, also reducing trade barriers, enhancing human capital formation, supporting research and development (R&D), improving institutions, and strengthening resilience to shocks and initiating regional integration in the neighbourhood as most value chains are regional (Sturgeon & Memedovic, 2011) can be the policy prescription so as to expand the share of the GVC pie while minimizing spill over risks associated with increased trade linkages.

## References

- [1]. ADB. (2015). *Asian Economic Integration Report: How can Special Economic Zones Catalyze Economic Development?* Manila: Asian Development Bank.
- [2]. Athukorala, P. C. (2012). Asian trade flows: Trends, patterns and prospects. *Japan and the World Economy*, 24(2), 150-162.
- [3]. Athukorala, P. C., & Yamashita, N. (2008). Patterns and determinants of production fragmentation in world manufacturing trade. *Globalisation, Regionalism and Economic Interdependence*, 45-72.
- [4]. Athukorala, Prema-chandra (2011). Asian trade flows: trends, patterns, and projections. ADB Economics Working Paper Series, No. 241. Manila: Asian Development Bank.
- [5]. Athukorala, Prema-chandra (2011). Asian trade flows: trends, patterns, and projections. ADB Economics Working Paper Series, No. 241. Manila: Asian Development Bank.
- [6]. Bagwell, K., & Sykes, A. (2005). India- Measures Affecting the Automotive Sector. *World Trade Review*, 4(1), 158-178.
- [7]. Baldwin, R., & Lopez-Gonzalez, J. (2015). Supply-chain trade: A portrait of global patterns and several testable hypotheses. *The World Economy*, 38(11), 1682-1721.
- [8]. Banga, R. (2013). Measuring value in global value chains. *Background paper RVC-8. Geneva: UNCTAD.*
- [9]. During the Industry Cycle of 2001-2002." MIT IPC Working Paper 03-002, May
- [10]. Escath, H, N Lindenber, and S Miroudot (2010) "International Supply Chains and Trade Elasticity in Times of Global Crisis," WTO Staff Working Paper ERSD201008
- [11]. Feenstra, R. C. (1998). Integration of trade and disintegration of production in the global economy. *Journal of economic Perspectives*, 12(4), 31-50.
- [12]. Gereffi, G (1994): "International Trade and Industrial Upgrading in the Apparel Commodity Chain", *Journal of International Economics*, Vol 48, pp 37-70.
- [13]. Giridharadas, A. (2007). India's edge goes beyond outsourcing. *The New York Times*, 4.
- [14]. Goldberg P., A. Khandelwal, N. Pavcnik, P. Topalova. 2008. Imported Intermediate Inputs and Domestic Product Growth: Evidence from India, Asian and Pacific Department, IMF, October.
- [15]. Gupta, N. (2015). India's Textiles and Clothing Industry in Global Value Chains and its Linkages with other Asian Countries.
- [16]. Hoda A. and Rai D.K. (2014) "Trade and Investment Barriers affecting International Production Networks in India"; Working Paper No 281; Indian Council for Research on International Economic Relations.
- [17]. Hummels, D., Ishii, J., & Yi, K. M. (2001). The nature and growth of vertical specialization in world trade. *Journal of international Economics*, 54(1), 75-96.
- [18]. Jones, R. W., & Kierzkowski, H. (2001). Horizontal aspects of vertical fragmentation. In *Global production and trade in East Asia* (pp. 33-51). Springer, Boston, MA.
- [19]. Kaplinsky, R (2005): *Globalization, Poverty and Inequality: Between a Rock and a Hard Place* (Cambridge: Polity Press).
- [20]. Kimura, Fukunari (2006). International production and distribution networks in East Asia: eighteen facts, mechanics, and policy implications. *Asian Economic Policy Review*, vol. 1, No. 2, pp. 326-344.
- [21]. Lall, S. (1999). Competing with labour: Skills and competitiveness in developing countries.
- [22]. Milberg, William and Deborah Winkler (2012): "Economic and Social Upgrading in Global Production Networks: Problems of Theory and Measurement", Brooks World Poverty Institute Working Paper Series ctg-2010-04, BWPI, The University of Manchester
- [23]. Miroudot, S., Lanz, R., & Ragoussis, A. (2009). Trade in intermediate goods and services.
- [24]. Mukherjee, D. (2018). "Indian Export Performance as Part of Global Value Chains," ISAS Working Paper.
- [25]. Nag, B. (2011). Trade Liberalisation and International Production Networks in Asia: Experience of Indian Automotive Sector.
- [26]. Ng, F., & Yeats, A. (2003). *Major trade trends in East Asia: what are their implications for regional cooperation and growth?* The World Bank.
- [27]. NITI Aayog Report on Make in India Strategy for Electronic Products (2016)
- [28]. Odgers Berndtson, (2016). "Outsourcing to India: Everything you wanted to know but were afraid to ask"



- [29]. OECD (2016), Upgrading Pathways in the Automotive Value Chain, OCED Initiative for Policy Dialogue on Global Value Chains, Production Transformation and Development, 7th Plenary Meeting, 10-11 November, Mexico City, Mexico
- [30]. OECD, Trade Policy Note (2016). "Benefitting from Participation in Global Value Chains".
- [31]. Prasad, H. A. C., Sathish, R., Kumar, S. V., Singh, S. S. S., & Sharma, S. R. K. (2017). Reviving and accelerating India's exports: policy issues and suggestions. *Government of India Ministry of Finance Department of Economic Affairs*.
- [32]. Reinhart, C. M., & Rogoff, K. S. (2008). This time is different: A panoramic view of eight centuries of financial crises (No. w13882). *National Bureau of Economic Research*.
- [33]. Sachs, J. (1997). International Economics: Unlocking the Mysteries of Globalization. *Foreign Policy*, 110, 97-111.
- [34]. Sturgeon, T. 2003. "Exploring the Risks of Value Chain Modularity: Electronics Outsourcing
- [35]. Sturgeon, T., & Memedovic, O. (2010). Measuring global value chains: intermediate goods trade, structural change and compressed development. *Vienna: UNIDO working paper*.
- [36]. Tiwari M, Veeramani C and Singh M. (2014) "The potential for involving India in regional production networks: Analyzing networked production and vertically specialized trade patterns between India and ASEAN
- [37]. UNCTAD (2009), "Impact of Global slowdown on India's exports and employment". United Nations Conference on Trade and Development (2013). World Investment Report 2013: Global value chains– Investment and Trade for Development. Sales No. E.13. II. D.5. Geneva.
- [38]. WTO, World trade Statistical Review (2017)
- [39]. Yeats, A.J. (2001). 'Just how big is global production sharing?', in (S.W. Arndt and H. Kierzkowski, eds). Fragmentation: New Production Patterns in the World Economy, Oxford: Oxford University.

## Appendix

A)

**Table 1: Share of High Technology Exports in Total Manufactured Exports of the country**

Countries	1990	1995	2000	2005	2010	2015	Rank
Philippines		39.28	73.39	73.49	61.80	62.74	1
Singapore	50.69	63.50	68.66	61.09	58.16	54.77	2
Malaysia	48.33	54.80	65.37	58.67	54.80	51.78	3
Malta	47.88	61.56	71.93	52.33	48.99	35.29	4
China		15.30	25.28	36.25	37.21	34.38	5
Korea, Rep.	22.19	33.54	39.77	38.92	35.41	34.16	6
Israel	17.99	20.07	26.72	16.68	22.75	27.10	7
France	17.09	20.80	25.43	20.43	24.23	25.78	8
Switzerland	13.12	15.16	17.13	17.83	21.40	22.87	9
Hungary		13.89	31.48	34.30	38.02	22.23	10
Japan	28.07	32.65	32.90	25.61	21.99	21.79	11
United Kingdom	22.38	29.05	31.22	24.44	17.24	21.46	12
United States	35.08	33.41	36.82	30.39	22.17	21.20	13
Germany	14.76	16.78	20.45	19.05	19.26	19.42	14
Russian Federation			10.14	8.64	10.07	13.25	15
Indonesia	2.46	7.65	20.78	17.85	15.27	11.71	16
Costa Rica		3.67	51.93	38.76	35.60	10.52	17
South Africa		4.76	7.61	7.53	6.36	7.77	18
India	<b>3.28</b>	<b>3.70</b>	<b>4.03</b>	<b>4.32</b>	<b>7.52</b>	<b>7.24</b>	<b>19</b>
Cyprus	0.53	0.77	1.36	6.49	30.36	6.33	20
Kenya	4.83	2.45	1.23	2.25	6.70		21

Source- Calculated from WITS UN-Comtrade

B) The correlation between gross exports and the ratio of FVA to DVA is presented for final and intermediate goods

Textiles	FVA/DVA i	FVA/DVA f
Gexp TIG	<b>-0.82</b>	-0.78
Gexp TFG	-0.83	<b>-0.80</b>

<b>Electronics</b>	FVA/DVA i	FVA/DVA f
Gexp EIG	<b>-0.05</b>	0.36
Gexp EFG	-0.18	<b>0.17</b>

Motor Vehicles	FVA/DVA i	FVA/DVA f
Gexp MVIG	<b>-0.75</b>	-0.76
Gexp MVFG	-0.73	<b>-0.79</b>

Where, Gexp TIG- Gross Exports of Textile Intermediate Goods

Gexp TFG- Gross Exports of Textile Final Goods

Gexp EIG- Gross Exports of Electronics Intermediate Goods

Gexp EFG- Gross Exports of Electronics Final Goods

Gexp MVIG- Gross Exports of Motor Vehicle Intermediate Goods

Gexp MVFG- Gross Exports of Motor Vehicle Final Goods

FVA/DVA i- Ratio of Foreign Value added to Domestic Value added for Intermediate goods.

FVA/DVA f- Ratio of Foreign Value added to Domestic Value added for Final goods.

C) The correlation between gross exports and the ratio of BPI to FPI is presented for different sectors.

<b>Sectors</b>	<b>BPI/FPI</b>
Textiles	0.83
Electronics	0.95
Motor Vehicles	0.65

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